

Claims

1. A system of communicating information over a
5 communication line which connects at least two protective relays for
an electric power line wherein communication between the two relays
is in the form of successive data messages which include output
status bits from one relay to the other relay, the output bits
representing the result of protection functions carried out by the
10 one relay, wherein the communication has a channel capacity which is
not completely used by the output bits transmitted, the
communication system of this invention comprising:

processing means for encoding additional data from said
one relay and inserting it into vacant channels in the communication
between the two relays;

means for including synchronization information for said
additional data on a synchronization channel in the communication,
as part of the successive data messages;

means for transmitting said data messages successively on
the communication line; and

processing means at the second relay for receiving and
decoding the successive data messages to produce replicated output
bits and the additional data transmitted from the one relay, wherein
the speed and security of the additional data is approximately at
25 least as good as that for the output bits.

2. A system of claim 1, wherein the additional data is
provided in a serial manner in said channels in successive data
messages.

30 3. A system of claim 1, wherein the additional data
includes analog data concerning one or more functions of the one
relay.

35 4. A system of claim 1, wherein the additional data
includes virtual terminal data originated by a user for transmission
to the other relay.

5. A system of claim 1, wherein the communication includes at least an eight channel capability.

5 6. A system of claim 1, wherein the additional data comprises successive analog quantities.

10 7. A system of claim 6, wherein each analog quantity is represented by a selected number of bits.

10 8. A system of claim 7, wherein the selected number is 18.

15 9. A system of claim 1, wherein the communication is in the form of successive frames of information, each frame comprising a selected number of data messages, each data message comprising a selected number of bits.

20 10. A system of claim 9, wherein the selected number of data messages is 18 and wherein the selected number of bits is eight.

25 11. A system of claim 9, including a bit recognition system for frame synchronization of the communication between the two relays, wherein the synchronization information includes a frame synchronization bit pattern recognizable by the bit recognition system, wherein all information received since a last successful frame synchronization is discarded if the messages comprising the frame have not all been accepted as valid.

30 12. A system of claim 1, wherein the information on the synchronization channel includes additional virtual terminal data, and an indication of whether virtual terminal information is included on the synchronization channel.

13. A system of claim 1, wherein the synchronization channel includes time synchronization information for aligning clocks in the two relays.